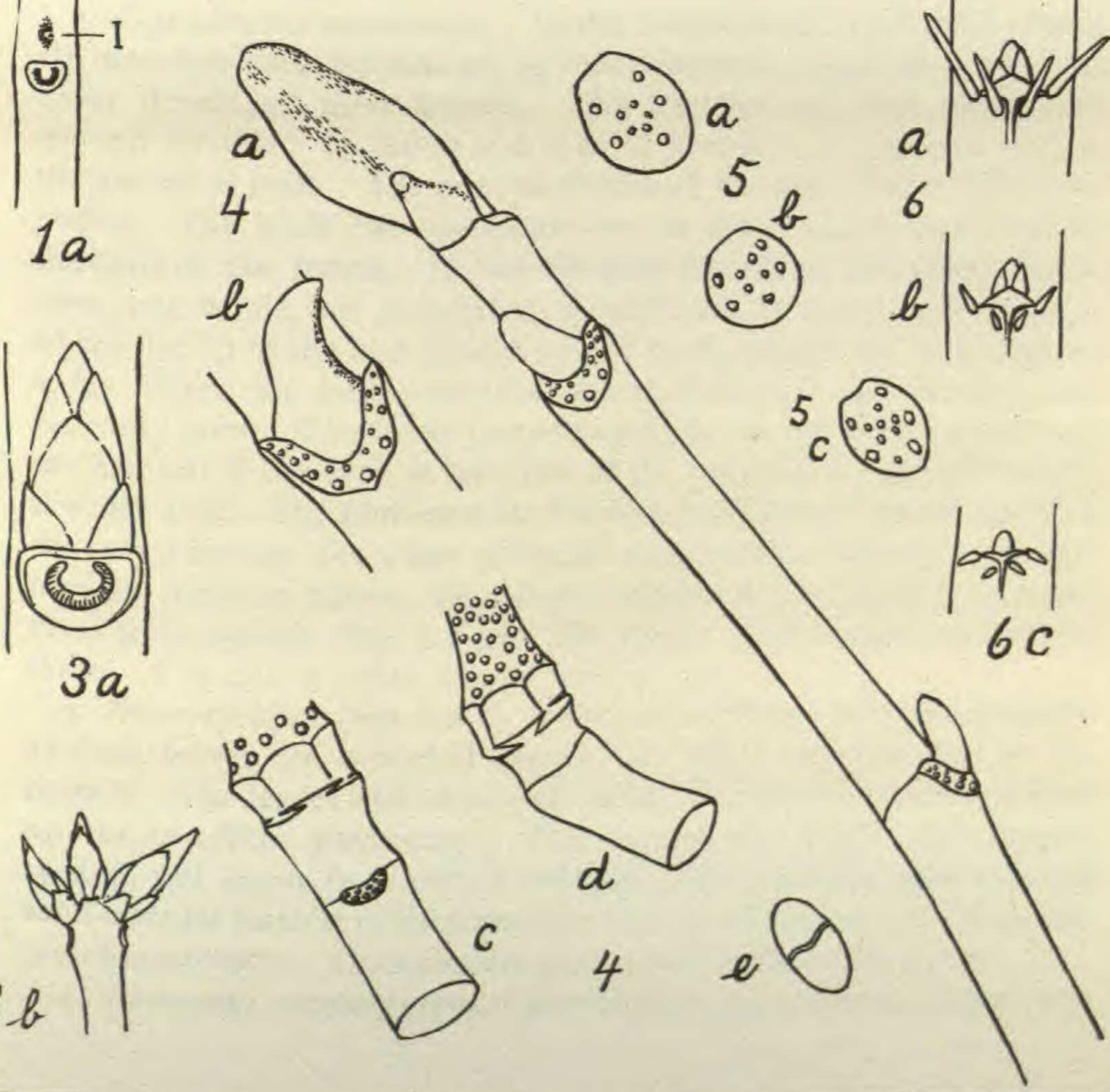
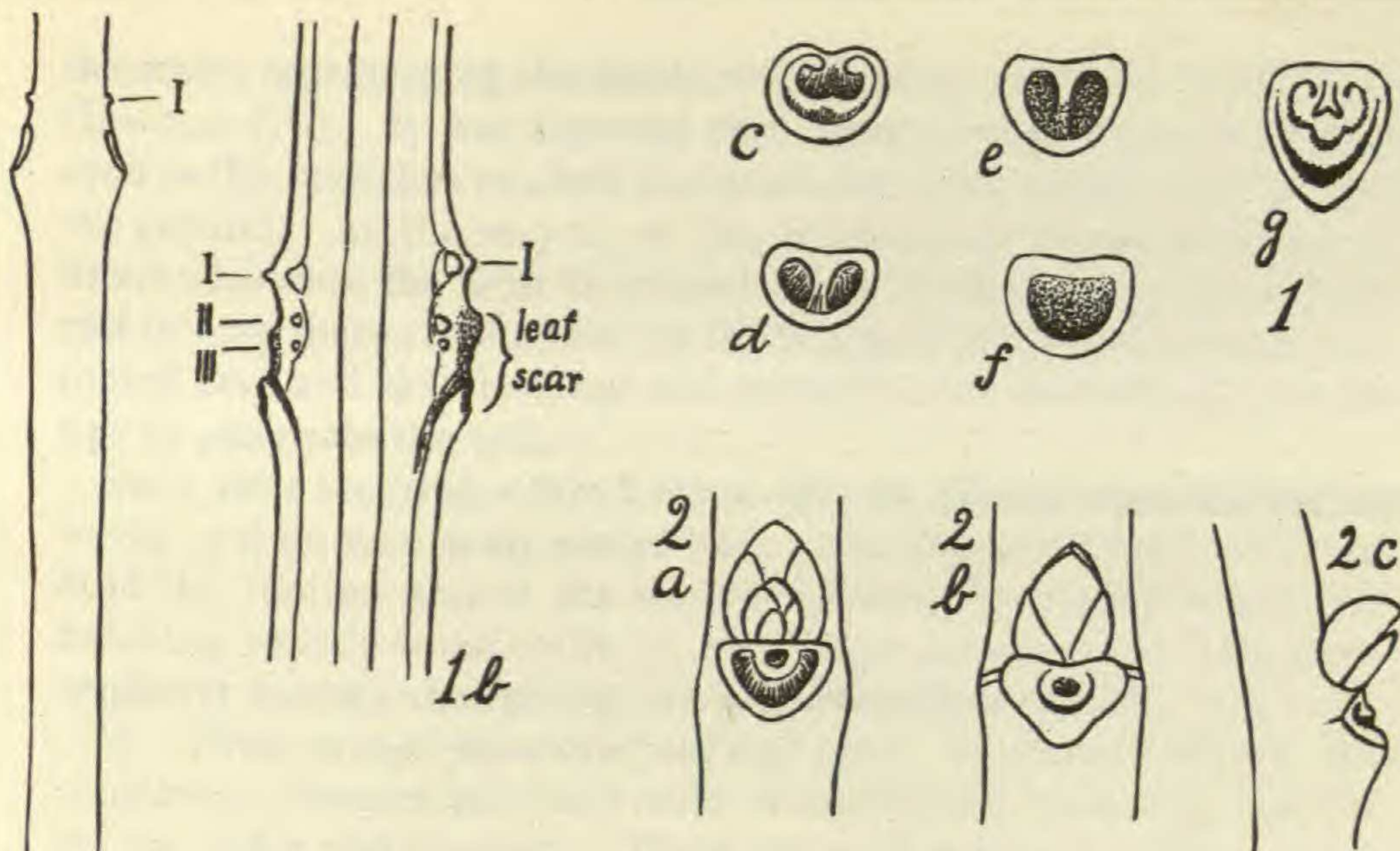


nium neck and projecting antheridia of the Leptosporangiatæ are secondary developments.—DOUGLAS HOUGHTON CAMPBELL, *Berlin, Germany*.

Botanical notes (WITH PLATE VIII). — I. *The spreading of raspberry bushes by a system of natural "layering."* *Rubus occidentalis*.—A few observations, apparently not hitherto recorded, gave rise to the following more complete account of a process, the more general facts of which were already well known. The internodes formed by the raspberry in later summer are considerably longer than those produced earlier in the season, and bear but few prickles. This later growth becomes recurved and seeks the ground, the newer internodes being very long. After the stem has developed to a certain length in this downward direction, the newer internodes are very rapidly shortened, and the prickles become very numerous as compared with their frequency elsewhere on the stem. It was very interesting to see that when the plant grew on the sides of cliffs this shortening of internodes took place, even when the ground had not been reached, and when the growing ends of the descending branches were fully illuminated by the sun. The habit of terminating the branches at a certain length by means of the shortened internodes covered with prickles seems to have become so strong that the branches go through the process even where, owing to their growth on the side of cliffs, the normal conditions, which must have given origin to this habit—the shade and dampness formed by leaves along the ground, and the presence of loose earth into which the branches could penetrate—do not exist. The prickles towards the tips of the branches are strongly curved backwards, in decided contrast to the ordinary prickles of the plant which are fairly straight, and are placed nearly at right angles to the stem. On reaching the ground the shortened internodes curve forwards and enter it obliquely. The recurved prickles prevent the tips which are just starting root from being readily torn out of the ground, catching hold of the underbrush and weeds among which they have rooted, and hooking into the ground itself.

As the joints began to lengthen during summer, the leaves grew smaller, and by the time the newer internodes were strongly shortened, preparatory to rooting, the leaves were reduced to small scales, subtending small scaly buds. Indeed, this reduction to scales takes place even in the open air, before the ground has been reached, but is universal on the rooting part of the stem.

Towards the tip of the branches, among the shortened internodes, the stem sends out rootlets. These do not come out at any point on the stem, but occur in two pairs, at each node, just below the base of



the scales representing the leaves at this point, as shown in the figure (figs. 6, *c*, *b*, *a*). It was observed that these rootlets began to grow as soon as the branches reached the shade, but often before they touched the ground. At the very tip of the descending branches, where the internodes were the most shortened, all of the nodes developed roots, and in case these reached the earth the tips of the branches were soon rooted fast, and that leverage was secured which enabled the growing tips to penetrate the soil.

Soon after securing a firm hold in the soil, the tip turns rapidly upwards and forms a scaly winter bud. About four to eight inches behind the rooting end of the branch, the stem is usually very brittle, breaking readily when cattle or other large animals pass through the raspberry bushes, thus giving rise to independent plants.

II. *Notes on superposed buds and leaf scars.* 1. *Rubus villosus*.—The blackberry presents excellent cases of superposed buds, the upper being the older and stronger. Three are quite common. The common raspberry also shows superposed buds.

2. *Cephalanthus occidentalis*. In the button-bush, the tips of almost all branches were terminated by inflorescences, a part of which had never developed their flowers. The few tips not thus terminated showed shriveled up leaves and ends of branches, dying back before the arrival of frost. The general growth of the stem is therefore sympodial. The bush has commonly two or three superposed buds in the axils of the leaves. In the autumn the tip of the upper bud is often not visible, but its position is indicated by a low protuberance where the tip of the bud presses up the epidermis of the bark (figs. 1, *a*, *b*). When the bud penetrates the epidermis, it appears only as a very tiny point. The lower one or two buds are not visible usually on the exterior of the bark at this time of the year, being hidden beneath the leaf scar. The fibrovascular bundles form a semi-lunate figure in the scar, entering the same obliquely and usually leaving a vertical median partition above; the general appearance of the scar is, however, quite variable (figs. 1, *c-g*). The leaves often occur in whorls of three. The pith is lightly tinged with brown.

3. *Ilex verticillata* (figs. 2, *a-c*). Three or four buds, and consequently as many leaves, are clustered around the larger terminal bud of the branch. The leaves with short and rather few serrations are arranged on the two-fifths phyllotaxy. The berries are bright red, several seeded, and occur in a sort of raceme. The leaf scar with a raised semi-circular fascicle of fibrovascular cells entering the scar obliquely, are characteristic. Occasionally superposed buds are observed.

4. *Euonymus atropurpureus*.—Branches round, greenish tinged with